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SOLAR OBSERVATIONS

SOLAR RADIATION MEASUREMENTS DURING SEPTEMBER, 1932

By IRVING F. HAND, Assistant in Solar Radiation Investigations

For a description of instruments employed and their exposures, the reader is referred to the January, 1932, REVIEW, page 26.

Table 1 shows that solar radiation intensities averaged above normal values for September at all three stations at which normal incidence measurements are made.

Table 2 shows an excess in the total solar radiation received on a horizontal surface at all pyr heliometric stations except Twin Falls, La Jolla, and Miami. The excess continues to be well marked in the larger cities.

Table 3 again shows diminished turbidity for the month with the decided increase in radiation receipt at Washington.

Polarization measurements obtained on 9 days at Washington give a mean of 57 per cent with a maximum of 65 per cent on the 28th. At Madison, measurements obtained on 12 days give a mean of 60 per cent with a maximum of 69 per cent on the 28th. These are average September values for Madison, but for Washington the values are somewhat above the September normals.

TABLE 1.—Solar radiation intensities during September, 1932

[Gram-calories per minute per square centimeter of normal surface]

Washington, D. C.													
Date	Sun's zenith distance										Local mean solar time		
	8 a.m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°		e.	
	75th mer. time	Air mass											
		A. M.					P. M.						
e.	5.0	4.0	3.0	2.0	*1.0	2.0	3.0	4.0	5.0	e.			
Sept. 2	mm. 17.96			cal. 0.49	cal. 0.70	cal. 1.06					mm. 20.57		
Sept. 3	19.89			0.50	0.70	1.06					19.89		
Sept. 6	16.20		0.76	0.96	1.05						13.13		
Sept. 7	7.57		1.02	1.15	1.26	1.37					7.04		
Sept. 9	10.97				1.27	1.47	1.17				8.48		
Sept. 10	6.27	0.53	0.64	0.76	0.94	1.21					6.76		
Sept. 12	9.47		0.73	0.85	1.16						8.48		
Means													
Departures													

TABLE 1.—Solar radiation intensities during September, 1932—Continued

Washington, D. C.—Continued

Date	Sun's zenith distance										Local mean solar time		
	8 a.m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°		e.	
	75th mer. time	Air mass											
		A. M.					P. M.						
e.	5.0	4.0	3.0	2.0	*1.0	2.0	3.0	4.0	5.0	e.			
Sept. 17	mm. 6.76			cal. 0.99	cal. 1.14	cal. 1.44	cal. 1.22	cal. 1.03	cal. 0.81	cal. 0.73	mm. 7.04		
Sept. 28	15.65			0.87	1.17	1.44	1.22	1.03	0.81	0.73	12.68		
Sept. 29	7.29	0.75	0.83	0.87	1.17	1.44	1.22	1.03	0.81	0.73	6.76		
Sept. 30	4.75	0.86	0.94	1.12	1.26	1.48	1.22	1.03	0.81	0.73	4.95		
Means		0.71	0.82	0.90	1.04	1.34	1.20	(1.03)	(0.81)	(0.73)			
Departures		+0.02	+0.07	+0.03	+0.00	+0.03	+0.14	+0.18	+0.08	+0.07			

Madison, Wis.

Sept. 6	7.29			1.19	1.27	1.51	1.30				7.57
Sept. 7	8.81			1.16	1.32	1.52	1.33	1.13			6.27
Sept. 8	7.04			1.05	1.29	1.41	1.19	0.98			8.48
Sept. 9	9.14			0.96	1.13	1.36	1.05	0.85			7.29
Sept. 10	11.81			0.71	0.97	1.38					10.59
Sept. 21	8.18		0.86	1.02	1.18	1.45					8.18
Sept. 23	6.27		1.08	1.20	1.37	1.58	1.36	1.16			6.50
Sept. 24	6.50		0.78	1.16	1.26						5.16
Sept. 28	4.75		0.90	1.20	1.34	1.50	1.35	1.10			6.27
Sept. 29	5.36		1.06	1.20	1.34	1.50	1.33	1.17			5.16
Sept. 30	5.16		0.94	1.06	1.24	1.45					6.27
Means			0.94	1.08	1.24	1.47	1.27	1.06			4.75
Departures			+0.04	+0.06	+0.08	+0.09	+0.11	+0.04			4.57

Lincoln, Nebr.

Sept. 1	9.47						1.27	1.04	0.98	0.90	8.18
Sept. 2	9.83						1.46	1.29	1.15		10.21
Sept. 3	9.47		0.97	1.00	1.21						10.59
Sept. 5	9.83		0.79	0.95	1.17	1.39	1.05	0.98	0.90	0.77	9.83
Sept. 6	8.48		0.87	1.00	1.17	1.39	1.20	1.03	0.91	0.76	12.68
Sept. 7	9.47	0.77	0.84	0.95	1.13	1.33	1.10	0.87	0.71		11.81
Sept. 13	10.21					1.37	1.15	0.97	0.83	0.73	9.14
Sept. 14	10.59					1.34	1.14	0.96	0.80	0.70	7.04
Sept. 16	6.76			1.02	1.19	1.42					9.47
Sept. 20	6.27	0.80	0.90	1.03	1.21	1.48	1.16	0.96	0.80	0.69	7.29
Sept. 27	6.02				1.31		1.21	1.10	1.00	0.90	5.56
Sept. 28	7.57			1.26	1.35	1.46					7.29
Sept. 29	7.29			1.02	1.37						4.95
Means		(0.78)	0.87	1.03	1.23	1.40	1.17	1.01	0.87	0.78	
Departures		+0.02	+0.04	+0.03	+0.05	+0.00	+0.03	+0.04	+0.04	+0.05	

* Extrapolated.

TABLE 2.—Average daily totals of solar radiation (direct + diffuse) received on a horizontal surface

Week beginning—	Gram calories per square centimeter												
	Washington	Madison	Lincoln	Chicago	New York	Fresno	Pitts-burgh	Fair-banks	Twin Falls	La Jolla	Gaines-ville	Miami	New Orleans
1932	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.
Sept. 3	474	453	518	432	388	569	396	250	519	260	282	430	424
Sept. 10	478	396	405	426	402	489	441	209	502	241	135	393	305
Sept. 17	379	389	398	368	380	509	342	153	436	185	222	457	-----
Sept. 24	432	349	396	286	348	426	329	114	387	240	247	464	313
Departures from weekly normals													
Sept. 3	+90	+77	+90	+110	+64	+39	+33	-----	-9	-65	-----	-26	-----
Sept. 10	+98	+43	-1	+123	+88	-24	+70	-----	-3	-56	-----	-65	-----
Sept. 17	+26	+47	+14	+78	+82	+27	-3	-----	-34	-111	-----	-11	-----
Sept. 24	+82	+55	+42	+26	+72	-19	+25	-----	-47	-79	-----	-2	-----
Accumulated departures on Sept. 30													
	+9,142	+1,990	-1,517	+16,298	+19,798	+8,110	+6,153	-----	-7,457	-474	-----	-3,383	-----

TABLE 3.—Solar radiation measurements and determinations of atmospheric turbidity factor (β), Washington, D. C., September, 1932.

TABLE 3.—Solar radiation measurements and determinations of atmospheric turbidity factor (β), Washington, D. C., September, 1932—Continued

Date and solar hour angle	Solar altitude, h.	Air mass, m.	I_m	I_y	I_r	β	Atmospheric dust particles per cubic centimeter	Notes: skylight polarization, P.; clouds, etc.
Sept. 2								
4:58 a.	16-59	3.39	0.458	0.364	0.273	0.140		Cirrus haze rest of day.
Sept. 6							407	
4:44 a.	18-45	3.10	0.878	0.672	0.554	0.090		
4:40 a.	19-31	2.98	0.980	0.677	0.558	0.055		
3:48 a.	29-22	2.04	1.058	0.789	0.616	0.095		P=56.
3:44 a.	30-07	1.99	1.054	0.795	0.621	0.100		
Sept. 7							342	
5:12 a.	13-04	4.35	0.982	0.768	0.627	0.040		
5:08 a.	13-52	4.12	1.004	0.774	0.616	0.040		
4:48 a.	17-45	3.26	1.097	0.823	0.665	0.040		
4:51 a.	18-18	3.17	1.121	0.826	0.669	0.040		
4:34 a.	20-28	2.84	1.145	0.862	0.677	0.045		
4:30 a.	21-12	2.75	1.170	0.866	0.683	0.040		
3:08 a.	36-23	1.69	1.291	0.888	0.738	0.080		P=52. Clouds.
3:04 a.	37-05	1.65	1.296	0.892	0.742	0.085		
Sept. 9							185	
4:09 a.	25-28	2.35	1.186	0.842	0.679	0.050		
4:02 a.	26-04	2.27	1.211	0.851	0.683	0.045		P=63.
2:50 a.	38-57	1.59	1.354	0.929	0.734	0.055		
2:46 a.	39-37	1.57	1.365	0.935	0.736	0.055		
0:52 a.	54-19	1.23	1.394	0.923	0.741	0.070		
0:48 a.	54-36	1.22	1.416	0.920	0.738	0.065		
1:52 p.	47-52	1.34	1.315	0.909	0.701	0.080		
1:56 p.	47-19	1.36	1.307	0.908	0.700	0.085		
2:29 p.	42-24	1.48	1.230	0.877	0.700	0.055		
2:32 p.	41-54	1.49	1.270	0.871	0.697	0.090		
3:20 p.	33-44	1.80	1.225	0.818	0.643	0.050		
4:15 p.	23-37	2.49	1.069	0.759	0.589	0.055		
Sept. 12							630	
4:39 a.	18-16	3.16	0.814	0.656	0.545	0.120		
4:36 a.	18-51	3.08	0.837	0.659	0.546	0.115		
4:23 a.	21-11	2.75	0.898	0.680	0.562	0.110		
4:20 a.	21-54	2.67	0.924	0.683	0.565	0.095		
3:02 a.	36-00	1.70	1.257	0.826	0.645	0.045		P=55.
2:58 a.	36-45	1.67	1.274	0.830	0.648	0.040		
Sept. 17								
4:45 a.	15-55	3.61	0.872	0.674	0.549	0.070	420	
4:41 a.	16-41	3.45	0.922	0.677	0.555	0.060		
4:00 a.	24-22	2.41	1.115	0.789	0.625	0.055		P=52. Clouds.
3:56 a.	25-07	2.36	1.115	0.784	0.628	0.060		
2:49 a.	39-50	1.67	1.150	0.824	0.659	0.100		
2:45 a.	37-28	1.64	1.169	0.832	0.662	0.100		
Sept. 28							554	
1:52 p.	41-37	1.51	1.363	0.995	0.741	0.060		
1:56 p.	41-04	1.52	1.330	0.988	0.741	0.080		
2:45 p.	34-10	1.78	1.268	0.874	0.689	0.060		
2:51 p.	33-30	1.81	1.287	0.879	0.692	0.060		P=65.
4:04 p.	20-42	2.81	1.037	0.771	0.622	0.070		
4:08 p.	19-58	2.92	1.036	0.776	0.625	0.065		
4:28 p.	16-17	3.54	0.972	0.723	0.584	0.045		
4:32 p.	15-32	3.70	0.960	0.767	0.586	0.045		
4:42 p.	13-38	4.19	0.773	0.624	0.528	0.090		
4:44 p.	13-16	4.30	0.767	0.627	0.533	0.090		
Sept. 29							287	
4:16 a.	18-16	3.17	0.965	0.796	0.604	0.070		
4:12 a.	19-00	3.05	0.973	0.741	0.607	0.075		
3:43 a.	24-15	2.43	1.062	0.789	0.637	0.080		
3:40 a.	24-46	2.37	1.078	0.794	0.643	0.080		
3:08 a.	30-14	1.98	1.144	0.862	0.683	0.110		P=58.
3:04 a.	30-53	1.94	1.158	0.865	0.686	0.100		
Sept. 30							195	
4:41 a.	14-06	4.05	0.928	0.789	0.619	0.070		
4:22 a.	16-55	3.41	1.076	0.832	0.656	0.045		
4:00 a.	20-55	2.78	1.145	0.859	0.684	0.055		
3:57 a.	21-28	2.71	1.150	0.860	0.687	0.055		
3:26 a.	26-52	2.20	1.203	0.876	0.721	0.070		
3:22 a.	27-36	2.15	1.240	0.879	0.725	0.065		
0:03 p.	48-31	1.33	1.411	0.974	0.739	0.055		P=56.
0:06 p.	48-30	1.33	1.417	0.977	0.739	0.050		
2:28 p.	36-20	1.69	1.256	0.905	0.707	0.080		
2:32 p.	35-45	1.71	1.292	0.901	0.706	0.065		